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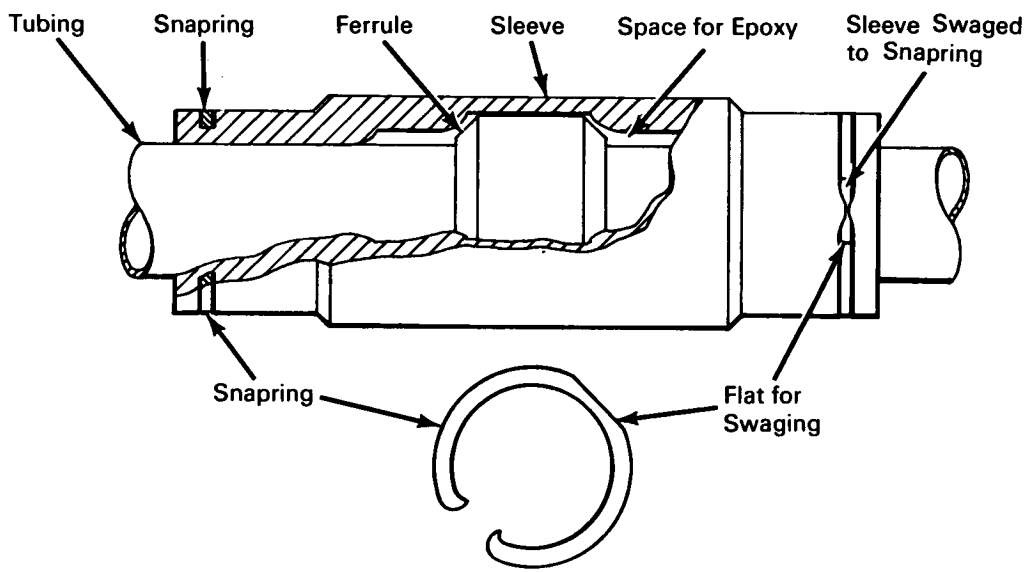
Corrected Copy

NASA TECH BRIEF

Pipe Joints Reinforced in Place with Fitted Aluminum Sleeves



The problem:

To devise a method of reinforcing solder-sealed ferrule joints in installed small-diameter aluminum tubing. The method must be capable of rapid execution, even in hard-to-reach or confined areas. An appropriate in-place reinforcement method would save the expense and time otherwise involved in the complete removal of tubing and the replacement of leaking or weakened joints.

The solution:

Reinforce the tubing joint with a fitted aluminum sleeve, using specially designed tools.

How it's done:

The reinforcement sleeve is made in two longitudinal halves for easy installation over the joint ferrule and a contiguous section of tubing. Epoxy cement is used to seal and bond the sleeve tightly around the joint assembly. Snaprings inserted in circumferential grooves position and hold the sleeve halves together. Each snapring is ground to a flat at the crown to allow the shield metal to be swaged over the ring at the flat area. The snaprings are quickly and accurately installed in one of the sleeve halves, by means of a special die and swaging punch, allowing the free ends of the rings to protrude equally beyond the cut edges of the sleeve half.

The inside of the sleeve is machined to the contour of the ferrule joint, with 0.040-inch clearance to accommodate the epoxy cement. A sufficient length of sleeve should be provided to allow an ample contact surface for sealing and bonding between the sleeve and tubing on both sides of the ferrule. Grooves for

(continued overleaf)

the snaprings are cut around the outside diameter of the sleeve near each end. The sleeve is then cut in half lengthwise with a 0.02-inch mill saw to form two identical shells.

Immediately prior to permanent installation over a joint, both shells of the sleeve are completely coated on the inside cleared surfaces with a commercial epoxy resin. The clamping action of the snaprings will aid in distributing the epoxy resin, and any excess expelled from the sleeve can be removed before jelling occurs (within 8 hours at room temperature). The epoxy resin will normally cure to standard test strength in approximately 24 hours and reach maximum strength in approximately 72 hours. Centering and installation of the shielding over joints in constricted working areas are greatly facilitated with specially designed centering and insertion tools. The insertion tool positions the sleeve halves over the tubing joint and locks them in place in a single, one-handed operation.

Notes:

1. Although the method was specificially designed for solder-sealed ferrule joints in small-diameter aluminum tubing, the same approach is adaptable to a variety of tubing sizes, materials, and joint types.
2. Tubing joints reinforced by this method have withstood considerable torsional, tensional, and vibrational stresses at moderately elevated temperatures. In tests for resistance to mechanical abuse, tubing and joint assemblies were bent to failure. All failures occurred in the tubing rather than in the reinforced joint.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas 77058
   Reference: B67-10271

Patent status:

No patent action is contemplated by NASA.

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